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Diapycnal Mixing in the Strait of Hormuz

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LONG-TERM GOALS

The long-term scientific goal of my research is to observe, understand and model smallscale turbulent mixing and to relate it to the mesoscale and largescale flow in which it is embedded. My effort is focused on coastal and marginal seas.

OBJECTIVES

The objectives of the *expanded*¹ project are

- to observe wintertime convection and the formation of dense water masses in the northern Adriatic Sea, to directly observe the vertical velocity associated with the convection and its space/time structure, to relate the convection to the local atmospheric forcing and to the surrounding mesoscale oceanic flow field, and
- to observe turbulent mixing in summertime current filaments in the central/northern Adriatic, to relate it to the mesoscale flow field, and to explore its role in the dynamics of the filaments.

APPROACH

1. *Wintertime cruise.* The observations of convection are part of a multi-project cruise planned for January 2003 on the R/V Knorr under the lead of Dr. Craig Lee (APL/UW). We will repeatedly deploy a "bottom lander" on the sea floor at depths of 50-70 m in the northern Adriatic. Deployments will be timed to coincide with bora wind events; they will last ca. 3 days, each. Locations of deployment will be in one of the known paths of bora winds. The bottom lander consists of a bottom-mounted, upward-looking 5-beam 600 kHz acoustic Doppler current profiler (ADCP) and a SeaCat conductivity-temperature depth (CTD) probe. The ADCP can measure vertical velocities in convective plumes directly. Bottom lander deployments will be accompanied by microstructure profiling and be embedded in surveys of the density and velocity field conducted by Dr. Lee with and undulating CTD and a shipboard ADCP. The observations of convection and their analysis will be very closely coordinated with Dr. Lee's work on the mesoscale flow.

¹See the section "Work Completed" below.

2. *Summertime cruise.* The cruise is planned for May 2003 on a chartered vessel, the R/V "Dallaporta" of Ancona, Italy. Measurements will be closely coordinated with simultaneous mesoscale observations by Dr. Lee on a separate research vessel. From the Dallaporta we will do microstructure profiling, measuring the turbulent dissipation rate, overturning scales and CTD data, as well as measure the flow field with an ADCP towed alongside the ship in a new fin.

WORK COMPLETED

As detailed in the previous annual report, work originally planned for the Strait of Hormuz in the winter of 2001/2002 had to be postponed in response to the general political situation after 9/11/01 and specifically also to the armed assault on the R/V Maurice Ewing in the Gulf of Aden in August 2001. In discussions with Dr. Steve Murray the scope of the field work was expanded to the Adriatic Sea, the general scientific objectives remaining the same.

In the report period the redirected field work was planned in its general direction as well as in its detail. Work during the two planned cruises and their coordination with Dr. Lee's work was discussed with him extensively during the past summer in Seattle. Back home in Miami planning focused on adapting instrumentation to their tasks and to the vessels used during the two planned cruises. As it became clear that we would not be able to mount an ADCP over the side of the R/V Dallaporta, we bought a V-Fin towfish from YSI Environmental. This fish is relatively small at a 5 foot span and rather lightweight such that it can be handled by a single person. The V-fin is specifically designed for Workhorse ADCPs. Cruise planning and coordination will continue with meetings in Trieste and Woods Hole in October 2002. Loading the R/V Knorr is planned for early December in Woods Hole.

RESULTS, IMPACT/APPLICATIONS, TRANSITIONS

New project.

RELATED PROJECTS

- *Adriatic Circulation Experiment - Mesoscale Dynamics and Response to Strong Atmospheric Forcing* (ONR, Craig Lee, PI). See above for close coordination with this project.
- *Adriatic Circulation Experiment (ACE)* (ONR, Perkins, Miller, Teague and Hwang, PIs). Most relevant for this project are the planned mooring arrays and also the modeling component.
- *Littoral Turbidity and Drift Modeling / NRL Monterey Coupled Ocean-Atmosphere Model.*
- *Red Sea Outflow Experiment* (NSF, Johns, Bower, Peters and Fratantoni, PIs): The outflow of the salty water from the Red Sea into the Gulf of Aden was observed during two cruises in January/February and August/September 2001 that covered the 'near field' in two separate outflow channels outside of the Strait of Bab el Mandeb as well as the 'far field' through much of the Gulf of Aden. Turbulence in the outflow plume was observed via Thorpe scales derived from CTD data observations with the bottom lander that include measurements of the Reynolds stress.